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(30)Priority

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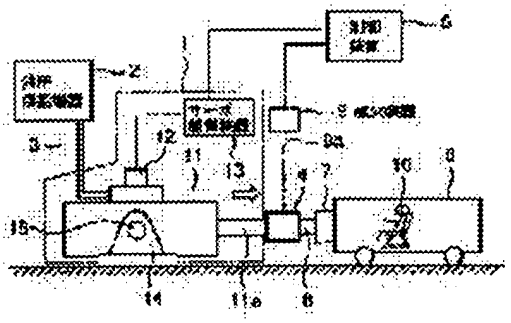
(54) SIMULATOR FOR AUTOMOBILE COLLISION ACCELARATION

(57)Abstract:

PURPOSE: To provide an automobile collision acceleration (G) simulator which enables real collision simulation to be performed and can evaluate a protection device at the time of collision with high precision.

CONSTITUTION: A controller 5 outputs a collision G command signal to a servo controller 13 to start a test. The servo controller 13 controls the hydraulic pressure supplied from a hydraulic pressure supply device 2 to an actuator 1 according to the command signal to actualize target G. Further, the controller 5 outputs an ignition command signal for a separation nut to an ignition device 9 after force application by the actuator 11. The ignition device 9 supplies a current to the separation nut on the basis of the ignition command signal to explosives thereby separating a super high speed joint 4. Since the output shaft 11a of the actuator 11 stops at its stroke end, a dummy vehicle 6 is disconnected from the output shaft 11a of the actuator 11 with its inertial force and then reduced in speed to stop. Consequently, force application with the collision G including a high frequency is enabled.



CLAIMS

[Claim(s)]

[Claim 1] An actuator and the hydraulic-pressure-supply equipment which supplies oil pressure to this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which used the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, The ignition which supplies the power source for ignition to the above-mentioned separation nut, The automobile collision G simulator characterized by providing the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned ignition after force application ending to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.

[Claim 2] An actuator and the hydraulic-pressure-supply equipment which supplies oil pressure to this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which does not use the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, The nut decollator which supplies a separation command signal to the above-mentioned separation nut, The automobile collision G simulator characterized by providing the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned nut decollator after force application ending to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the automobile collision G simulator which used the ultra high-speed decollator.
[0002]
[Description of the Prior Art] The conventional automobile collision G simulator is constituted as shown in drawing 8 . That is, an actuator 21 is formed to the abutment test wall 20 by which fixed installation was carried out on a floor line, and the pressurization section 23 of the simulation car 22 is located so that the actuator output-shaft 21a may be countered. A human phantom 24 is installed in the seat in the above-mentioned simulation car 22. And an air supply 25 is connected with the above-mentioned actuator 21 through the closing motion bulb 26 and the pneumatics piping 27.
[0003] In the above-mentioned configuration, in performing simulation, by opening the closing motion bulb 26 rapidly, you supply the pneumatic pressure from an air supply 25 to an actuator 21 through the pneumatics piping 27, actuator output-shaft 21a makes it collide with the pressurization section 23 of the simulation car 22, and it absorbs the reaction force at that time with an abutment test wall 20.
[0004]
[Problem(s) to be Solved by the Invention] Since the method which actuator output-shaft 21a and the simulation car 22 have separated [method] the above-mentioned conventional automobile collision G simulator, and makes actuator output-shaft 21a collide with the pressurization section 23 of the simulation car 22 is used, simulation extent of G fundamental wave is a limitation.
[0005] Moreover, although it is possible to operate a hydraulic servo valve as a joint mold which combined actuator output-shaft 21a and the simulation car 22 so that Target G may be acquired, since the stroke of an actuator becomes long, responsibility cannot worsen, and Target G cannot be acquired as a result.
[0006] While this invention was made in view of the above-mentioned actual condition and carries out the stroke of an actuator to the minimum stroke required for force application, Target G is realized by separating the actuator after force application termination, and a simulation car, and more realistic collision simulation is possible and it aims at offering the automobile collision G simulator which can perform evaluation of the protective device at the time of a collision etc. with high degree of accuracy.
[0007]
[Means for Solving the Problem] The hydraulic-pressure-supply equipment with which the automobile collision G simulator concerning this invention supplies oil pressure to an actuator and this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which used the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, It is characterized by providing the ignition which supplies the power source for ignition to the above-mentioned separation nut, and the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned ignition after force application ending to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.
[0008] Moreover, the automobile collision G simulator concerning this invention An actuator and the hydraulic-pressure-supply equipment which supplies oil pressure to this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which does not use the powder which connects between the output shaft of the above-mentioned actuator, and simulation

cars, It is characterized by providing the nut decollator which supplies a separation command signal to the above-mentioned separation nut, and the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned nut decollator after force application ending to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.

[0009]

[Function] If a trial start signal is inputted into a control device, a control device is predetermined timing, will output a collision G command signal to a servo control means, and will start a trial. A servo control means controls the oil pressure supplied to an actuator from hydraulic-pressure-supply equipment based on a servo-system command signal, and realizes Target G.

[0010] On the other hand, a control device outputs the ignition command signal of a separation nut to an ignition after the force application termination by the actuator. An ignition supplies a current to a separation nut based on an ignition command signal, lights a powder, and separates a ultra high-speed separation joint. Since the output shaft of an actuator stops by the stroke edge, a simulation car is separated from the output shaft of an actuator by inertial force, moves that rate when dissociating, is slowed down after that and stops.

[0011] Moreover, when the ultra high-speed separation joint which does not use a powder is used, it is that a nut decollator controls a ultra high-speed separation joint according to the command from a control unit, and the same actuation as the case of the ultra high-speed separation joint which used the above-mentioned powder is performed.

[0012] Target G is given to the human phantom in a simulation car as mentioned above, and the amount of many then generated in a human phantom is measured. Consequently, while the stroke of an actuator is made to the minimum stroke required for force application, by separating the actuator after force application termination, and a simulation car, the force application of the collision G containing a RF becomes possible, and the more realistic collision simulation of it becomes possible.

[0013]

[Example] Hereafter, the example of this invention is explained with reference to a drawing.

(The 1st example) Drawing 1 is the overall block diagram of the automobile collision G simulator concerning the 1st example of this invention. In drawing 1 , 1 is servo system and consists of trunnion bearing 14 which equipped the bearing of an actuator 11, a servo valve 12, a servo control 13, and a self-aligning mold. The above-mentioned trunnion bearing 14 is installed on a floor line, and holds an actuator 11 through trunnion 15. The above-mentioned servo valve 12 controls the oil pressure supplied to an actuator 11 through a hydraulic line 3 from hydraulic-pressure-supply equipment 2, and it carries out a switching action according to the command from a servo control 13. Moreover, a control command is given to this servo control 13 from the control unit 5 which manages the whole control.

[0014] And output-shaft 11a of the above-mentioned actuator 11 is connected with the simulation car 6 through the ultra high-speed separation joint 4. The human phantom 10 is installed in the seat of this simulation car 6, and when Target G is given, the amount of many generated in a human phantom 10 is measured. Moreover, the right-and-left revolving shaft 7 which equipped the above-mentioned simulation car 6 with the bearing of a self-aligning mold is established, and this right-and-left revolving shaft 7 is connected with the above-mentioned ultra high-speed separation joint 4 through a connecting shaft 8. This ultra high-speed separation joint 4 is what was constituted with the separation nut which used the powder so that a detail may be mentioned later, and firing current is supplied through electric-wire 9a for ignition from switchpoint fire equipment 9. The above-mentioned ignition 9 consists of a power source, a switch, etc. for separation nut ignition, and operates according to the control command from the above-mentioned control unit 5.

[0015] The above-mentioned control device 5 is constituted by a processor 5-1 and the servo-system command signal dispatch section 5-2 as shown in drawing 2 , and a processor 5-1 starts actuation with a test initiation input signal. While a servo-system command signal is sent to the above-mentioned servo control 13

from the servo-system command signal dispatch section 5-2 by this, an ignition command signal is sent to the above-mentioned ignition 9 from a processor 5-1.

[0016] Next, drawing 3 explains the detail of the above-mentioned ultra high-speed separation joint 4. This ultra high-speed separation joint 4 carries out phase opposite of 1 set of joints which combined the joint plate 4-2 with the lock-pin 4-3, with 1 set of bolts 4-4, and the separation nut 4-5, puts a washer 4-6 into the body 4-1 of a joint of a fork mold, and combines with it. The larger bore 4-7 than the diameter of a bolt 4-4 is formed in the core of the above-mentioned joint plate 4-2, and even if the heart of the body 4-1 of a joint on either side shifts somewhat, a bolt 4-4 is attached. Separation actuation is made to perform using a powder and the above-mentioned separation nut 4-5 is U.S. Hi-Shear. "SN1100 and SN2100 seriees Non-Captive Separation Nuts" is put on the market from Corporation. Moreover, the separation bolt besides a separation nut is also put on the market and the same actuation can be made to perform instead of the above-mentioned separation nut 4-5 using a separation bolt.

[0017] And after the separation nut's 4-'s5 dissociating, it disperses, or covering 4-8 is being fixed to the body 4-1 of a joint with the fixed screw 4-9 so that the bolt 4-4 grade from which it escaped may not disperse. The above-mentioned covering 4-8 is attached, and has structure which can be removed. Moreover, electric-wire 9a for ignition from the above-mentioned ignition 9 is connected to the above-mentioned separation nut 4-5. It is fixed to the body 4-1 of a joint by the electric-wire clamp 4-10, and electric-wire 9a for ignition contacts covering 4-8, and he is trying for cutting etc. not to generate this electric-wire 9a for ignition by the impact under trial, and vibration.

[0018] When using the above-mentioned ultra high-speed separation joint 4, while forming the trunnion bearing 14 which equipped the bearing of a self-aligning mold and receiving trunnion 15 in an actuator 11 side so that bending stress with the bolt 4-4 equipped with the separation nut 4-5 impossible for etc. may not be added, in this example, the right-and-left revolving shaft 7 which the simulation car 6 side also equipped with the bearing of a self-aligning mold is established. In addition, if it is the device which the force of affecting actuation of the separation nut 4-5 does not commit, of course, other devices may be used.

[0019] Next, actuation of the above-mentioned example is explained. In case a trial is started, a trial start signal is inputted into the control unit 5 in drawing 1 by actuation of turning on a start switch. Thereby, as the processor 5-1 shown in drawing 2 operates and it is shown in drawing 4 , a control unit 5 is a certain specified timing, from the servo-system command signal dispatch section 5-2, outputs a collision G command signal to servo system 1, and starts a trial. It is t0 at this output initiation time. It is referred to as "0" of time base. A servo valve 12 is opened based on the servo-system command signal by which the servo control 13 of servo system 1 was sent from the above-mentioned servo-system command signal dispatch section 5-2, and it came, the oil pressure supplied to an actuator 11 through a hydraulic line 3 from hydraulic-pressure-supply equipment 2 is controlled, and G wave shown in drawing 4 is realized.

[0020] Moreover, the processor 5-1 in the control unit 5 shown in drawing 2 is the operating time of delta 1 and the separation nut 4-5 about the operating time of an ignition 9 delta 2 When it carries out, it is deltatF =deltat1 from time base "0". - (delta1+delta2)

When it passes, the ignition command signal of the separation nut 4-5 is sent, and it outputs to an ignition 9. Based on the above-mentioned ignition command signal, through electric-wire 9a for ignition, an ignition 9 supplies a current to the separation nut 4-5 from the power source for ignition, and lights a powder. The separation nut 4-5 dissociates by this, it separates from a bolt 4-4, and, as for the ultra high-speed separation joint 4, 1 set of bodies 4-1 of a joint are divided into right and left. On the other hand, since output-shaft 11a of an actuator 11 stops by the stroke edge, the simulation car 6 is separated from output-shaft 11a of an actuator 11 by inertial force, and it moves that rate when dissociating, and is deltat2. It slows down and stops, after ending separation.

[0021] t0 to which measurement of data started the trial deltat2 to which the simulation car 6 ended separation from the time up to -- it carries out. That is, as shown in drawing 4 , Target G is given to a human phantom

10, and the amount of many then generated in a human phantom 10 is measured. Target G -- G fundamental-wave top -- oscillating G of a RF -- deltat1 up to -- it is added and the condition of "0" G maintains after it -- having -- the test initiation back deltat2 A trial is ended.
[0022] deltat1 which started separation so that above-mentioned drawing 4 might show although there is no need for force application henceforth -- if -- deltat2 of separation termination up to -- supposing output-shaft 11a of an actuator 11 and the simulation car 6 were combined -- which -- about -- it is as follows, when an unnecessary stroke is needed or an order check is carried out.
[0023] Generally it is deltat1. It is abbreviation 0.1sec (second). At this time, the simulation car 6 is maximum velocity Vmax. It is abbreviation 15 m/sec. Therefore, the unnecessary stroke in this case is [0024].
[Equation 1]

$$\ell \fallingdotseq (\Delta t2 - \Delta t1)\ Vmax$$

$$\fallingdotseq 3 \Delta t1\ Vmax$$

$$= 3 \times 0.\ 1\,(sec) \times 15\,(m/sec)$$

$$= 4.\ 5\ (m)$$

It becomes. In addition, since a stroke required for force application is 1m or less, it is understood that the value of an unnecessary stroke is very large. Moreover, it is [0025] supposing separation time amount shifts 1/1000sec.
[Equation 2]

$$\Delta \ell \fallingdotseq 1500\,(cm/sec) \times 1 / 1000\,(sec)$$

$$= 1.\ 5\,(cm)$$

A stroke will change.
[0026] For this reason, a decollator is deltat2. It is necessary to dissociate by ultra high-speed correctly. Since the mass of a separation joint influences the force application engine performance directly, it needs to collect lightweight.
[0027] deltat1 it indicates from test initiation that described above to drawing 4 ****** -- the stroke of an actuator 11 can be shortened, the degradation by the compressibility of an oil etc. can stop, and the force application of the collision G containing a RF becomes possible by combining with the simulation car 6, carrying out force application of the output-shaft 11a of an actuator 11 through the ultra high-speed separation joint 4, operating the ultra high-speed separation joint 4 after it, and separating the simulation car 6.
[0028] In addition, when receiving a load and not going out, you may make it use it combining two separation nuts 4-5 with one separation nut, as shown in drawing 5 although the above-mentioned example explained the case where one separation nut 4-5 was used. Drawing 5 (a) is the sectional view of the ultra high-speed separation joint 4, and this drawing (b) is the side elevation. In the example shown in this drawing 5 , the head of 1 set of bodies 4-1 of a joint was formed in the shape of a flange, opposite arrangement was carried out, with 2 sets of bolts 4-4, and the separation nut 4-5, the washer 4-6 was put in and that periphery section is combined. A current is supplied to two above-mentioned separation nuts 4-5 through electric-wire 9a for ignition from an ignition 9. And covering 4-8 is arranged on the outside of the body 4-1 of a joint, and it is fixing with the fixed screw 4-9. Moreover, the screwhole 4-11 for connecting the connecting shaft 8 of output-shaft 11a of an actuator 11 and the simulation car 6 is formed in the core of the body 4-1 of a joint.
[0029] A sufficiently big load can be borne by using two separation nuts 4-5 as mentioned above. Moreover, when dependability high about others, especially the separation nut 4-5 is required, it replaces with a bolt 4-4, a stud is used, and you may make it equip the both ends with the separation nut 4-5 in the ultra high-speed separation joint 4 shown in drawing 3 . Thus, separation of the simulation car 6 can be ensured by using it combining two separation nuts 4-5.

[0030] (The 2nd example) Drawing 6 is the overall block diagram of the automobile collision G simulator concerning the 2nd example of this invention. This 2nd example is what used ultra high-speed separation joint 4A which replaces with the ultra high-speed separation joint 4 which used the powder, and does not use a powder, and a nut separation signal is supplied through separation signal-line 9b from nut decollator 9A. The above-mentioned nut decollator 9A consists of a power source for high-speed separation nut actuation, a relay, etc., and operates according to the control command from the above-mentioned control unit 5. Since other configurations are the same configurations as drawing 1 , the same sign as drawing 1 is attached and detailed explanation is omitted.

[0031] Next, drawing 7 explains the detail of the above-mentioned ultra high-speed separation joint 4A. This ultra high-speed separation joint 4A carries out phase opposite of the body of 1 set of joints 4a, by 1 set of bolt 4b and separation nut 4c, puts in washer 4d and joins together. In this case, larger bore 4e than the diameter of bolt 4b is prepared in the core of the opposed face of the above-mentioned body of joint 4a, and even if the heart of body of joint 4a on either side shifts somewhat, bolt 4b is attached. Moreover, separation nut 4c is being beforehand fixed to one body of joint 4a by 4f of mounting bolts.

[0032] An electric and mechanical operation is made to perform separation actuation, without using a powder, and the above-mentioned separation nut 4c is U.S. G&H Technology.Inc. "Separation Nut of Model 9421-2 and Model 8500" is put on the market.

[0033] And separation signal-line 9b from above-mentioned nut decollator 9A is connected to above-mentioned separation nut 4c. It is fixed to body of joint 4a by electric-wire clamp 4g, and he is trying for faults, such as an open circuit, not to produce this separation signal-line 9b by the impact under trial, and vibration.

[0034] Also in the automobile collision G simulator of drawing 6 which used ultra high-speed separation joint 4A which does not use the above-mentioned powder, based on the directions from a control unit 5, the completely same actuation as said 1st example is performed, and the same effectiveness can be acquired.

[0035]

[Effect of the Invention] Since it was made to realize Target G by separating the actuator after force application termination, and a simulation car according to this invention while carrying out the stroke of an actuator to the minimum stroke required for force application as a full account was given above, the force application of the collision G containing a RF becomes possible, more realistic collision simulation is possible and evaluation of the protective device at the time of a collision etc. can be performed with high degree of accuracy.

TECHNICAL FIELD

[Industrial Application] This invention relates to the automobile collision G simulator which used the ultra high-speed decollator.

PRIOR ART

[Description of the Prior Art] The conventional automobile collision G simulator is constituted as shown in drawing 8 . That is, an actuator 21 is formed to the abutment test wall 20 by which fixed installation was carried out on a floor line, and the pressurization section 23 of the simulation car 22 is located so that the actuator output-shaft 21a may be countered. A human phantom 24 is installed in the seat in the above-mentioned simulation car 22. And an air supply 25 is connected with the above-mentioned actuator 21 through the closing motion bulb 26 and the pneumatics piping 27.

[0003] In the above-mentioned configuration, in performing simulation, by opening the closing motion bulb 26 rapidly, you supply the pneumatic pressure from an air supply 25 to an actuator 21 through the pneumatics piping 27, actuator output-shaft 21a makes it collide with the pressurization section 23 of the simulation car 22, and it absorbs the reaction force at that time with an abutment test wall 20.

EFFECT OF THE INVENTION

[Effect of the Invention] Since it was made to realize Target G by separating the actuator after force application termination, and a simulation car according to this invention while carrying out the stroke of an actuator to the minimum stroke required for force application as a full account was given above, the force application of the collision G containing a RF becomes possible, more realistic collision simulation is possible and evaluation of the protective device at the time of a collision etc. can be performed with high degree of accuracy.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Since the method which actuator output-shaft 21a and the simulation car 22 have separated [method] the above-mentioned conventional automobile collision G simulator, and makes actuator output-shaft 21a collide with the pressurization section 23 of the simulation car 22 is used, simulation extent of G fundamental wave is a limitation.

[0005] Moreover, although it is possible to operate a hydraulic servo valve as a joint mold which combined actuator output-shaft 21a and the simulation car 22 so that Target G may be acquired, since the stroke of an actuator becomes long, responsibility cannot worsen, and Target G cannot be acquired as a result.

[0006] While this invention was made in view of the above-mentioned actual condition and carries out the stroke of an actuator to the minimum stroke required for force application, Target G is realized by separating the actuator after force application termination, and a simulation car, and more realistic collision simulation is possible and it aims at offering the automobile collision G simulator which can perform evaluation of the protective device at the time of a collision etc. with high degree of accuracy.

MEANS

[Means for Solving the Problem] The hydraulic-pressure-supply equipment with which the automobile collision G simulator concerning this invention supplies oil pressure to an actuator and this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which used the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, It is characterized by providing the ignition which supplies the power source for ignition to the above-mentioned separation nut, and the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned ignition after force application ending to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.

[0008] Moreover, the automobile collision G simulator concerning this invention An actuator and the hydraulic-pressure-supply equipment which supplies oil pressure to this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which does not use the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, It is characterized by providing the nut decollator which supplies a separation command signal to the above-mentioned separation nut, and the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned nut decollator after force application ending to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.

OPERATION

[Function] If a trial start signal is inputted into a control device, a control device is predetermined timing, will output a collision G command signal to a servo control means, and will start a trial. A servo control means controls the oil pressure supplied to an actuator from hydraulic-pressure-supply equipment based on a servo-system command signal, and realizes Target G.

[0010] On the other hand, a control device outputs the ignition command signal of a separation nut to an ignition after the force application termination by the actuator. An ignition supplies a current to a separation nut based on an ignition command signal, lights a powder, and separates a ultra high-speed separation joint. Since the output shaft of an actuator stops by the stroke edge, a simulation car is separated from the output shaft of an actuator by inertial force, moves that rate when dissociating, is slowed down after that and stops.

[0011] Moreover, when the ultra high-speed separation joint which does not use a powder is used, it is that a nut decollator controls a ultra high-speed separation joint according to the command from a control unit, and the same actuation as the case of the ultra high-speed separation joint which used the above-mentioned powder is performed.

[0012] Target G is given to the human phantom in a simulation car as mentioned above, and the amount of many then generated in a human phantom is measured. Consequently, while the stroke of an actuator is made to the minimum stroke required for force application, by separating the actuator after force application termination, and a simulation car, the force application of the collision G containing a RF becomes possible, and the more realistic collision simulation of it becomes possible.

EXAMPLE

[Example] Hereafter, the example of this invention is explained with reference to a drawing.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram of the automobile collision G simulator concerning the 1st example of this invention.

[Drawing 2] The block diagram showing the main configurations of the control device in this example.

[Drawing 3] Drawing in which carrying out the cross section of a part of configuration of the ultra high-speed separation joint in this example, and showing it.

[Drawing 4] Drawing for explaining the measurement actuation in this example.

[Drawing 5] Drawing showing other examples of a configuration of the ultra high-speed separation joint in this invention.

[Drawing 6] The block diagram of the automobile collision G simulator concerning the 2nd example of this invention.

[Drawing 7] Drawing in which carrying out the cross section of a part of configuration of the ultra high-speed separation joint in this example, and showing it.

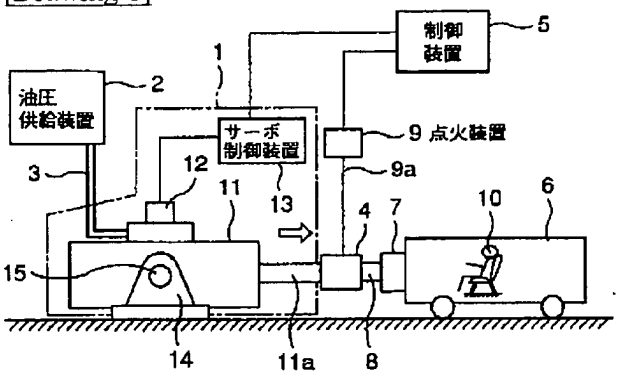
[Drawing 8] The block diagram of the conventional automobile collision G simulator.

[Description of Notations].

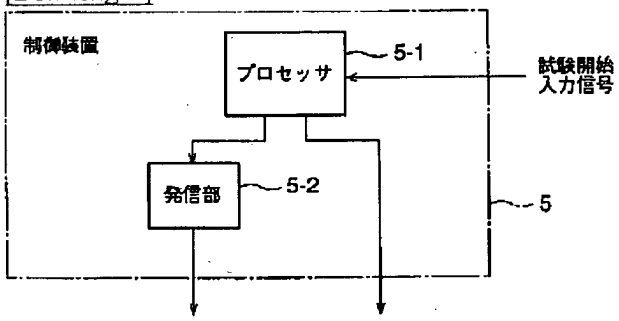
1 Servo System
2 Hydraulic-Pressure-Supply Equipment
3 Hydraulic Line
4 4A Ultra high-speed separation joint
4-1, 4a Body of a joint
4-2 Joint Plate
4-3 Lock-pin
4-4, 4b Bolt
4-5, 4c Separation nut
4-6, 4d Washer
4-7, 4e Bore
4-8 Covering
4-9 Fixed Screw
4-10, 4g Electric-wire clamp
5 Control Unit
6 Simulation Car
7 Right-and-Left Revolving Shaft
8 Connecting Shaft
9 Ignition
10 Human Phantom
11 Actuator
11a Actuator output shaft
12 Servo Valve
13 Servo Control
14 Trunnion Bearing
15 Trunnion

DRAWINGS

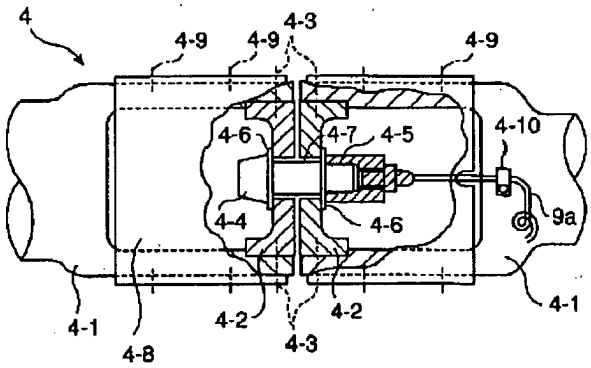
[Drawing 1]



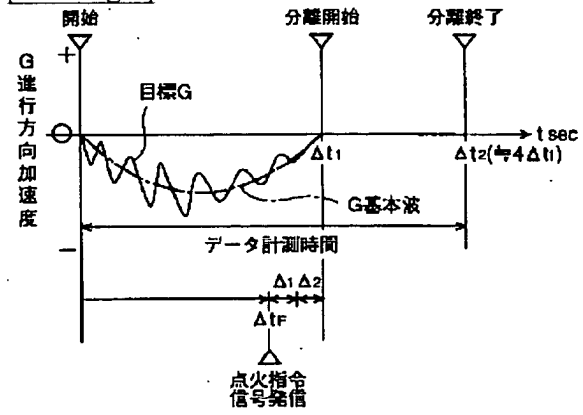
[Drawing 2]



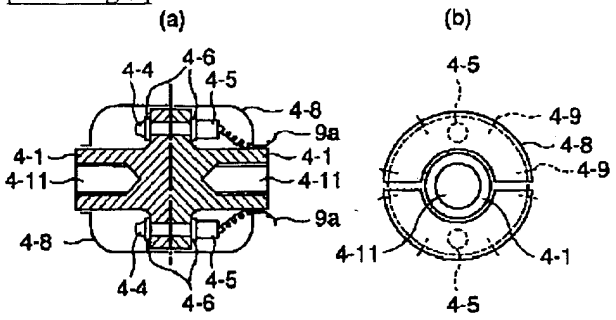
[Drawing 3]



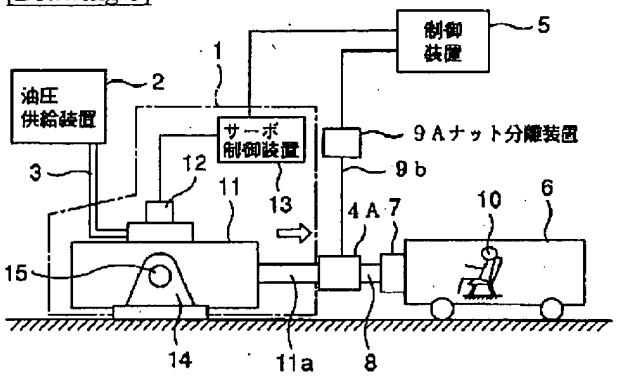
[Drawing 4]



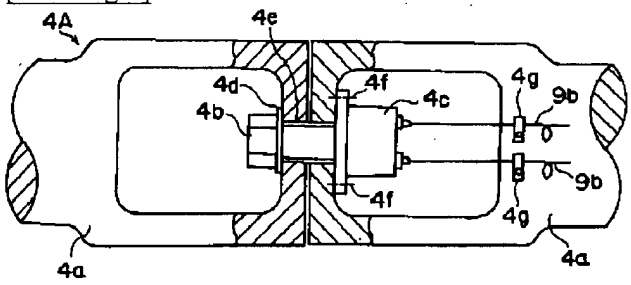
[Drawing 5]



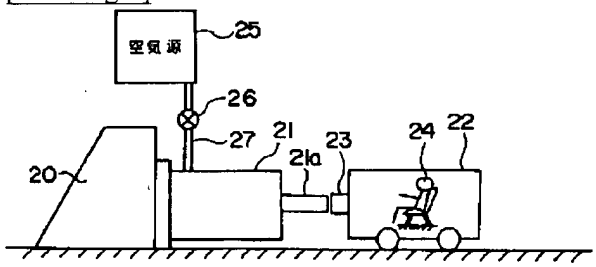
[Drawing 6]



[Drawing 7]



[Drawing 8]

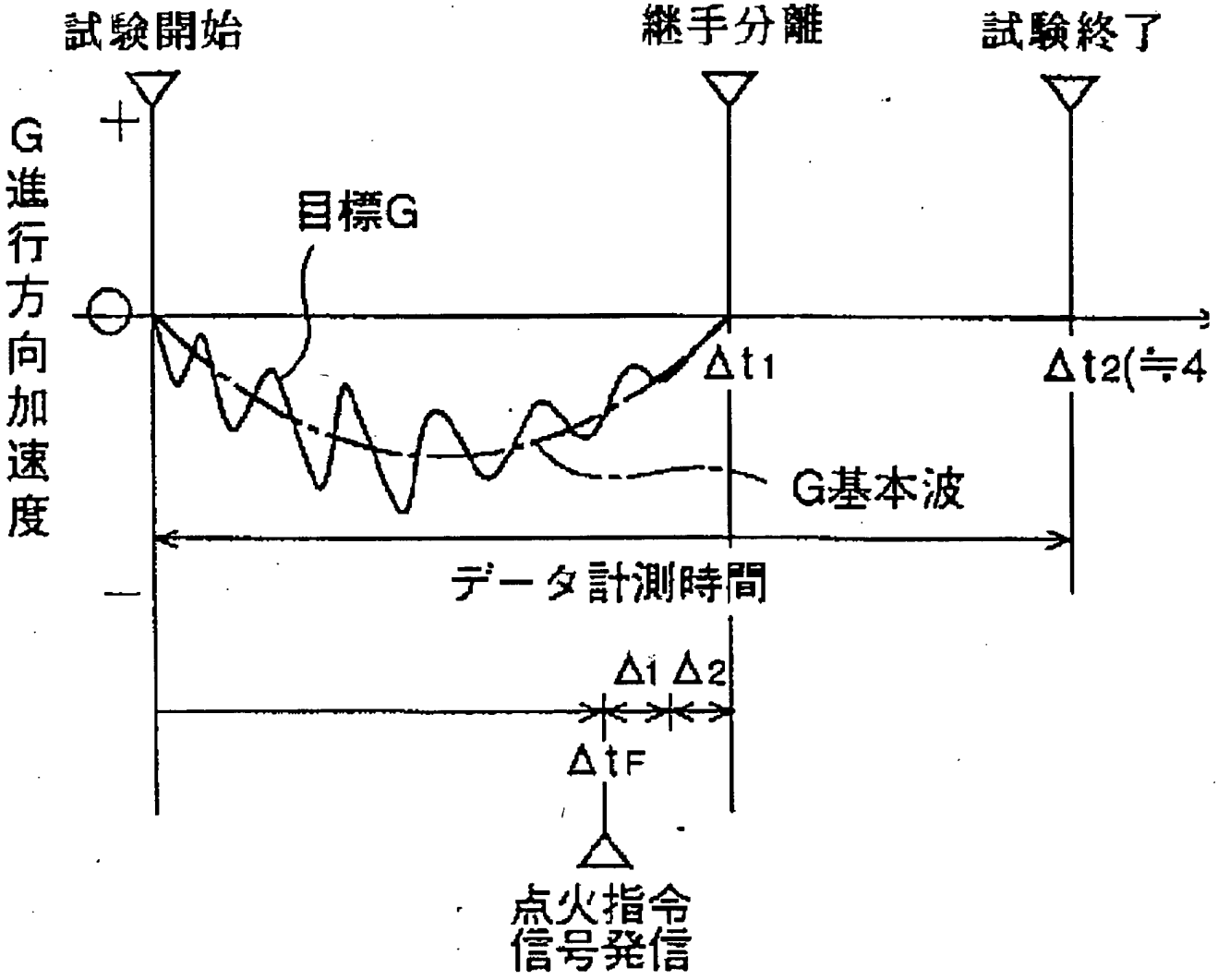


WRITTEN AMENDMENT

---------- [a procedure revision]
[Filing Date] January 11, Heisei 7
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]
[Claim 1] An actuator and the hydraulic-pressure-supply equipment which supplies oil pressure to this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which used the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, The ignition which supplies the power source for ignition to the above-mentioned separation nut, The automobile collision G simulator characterized by providing the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned ignition at the time of the force application termination to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.
[Claim 2] An actuator and the hydraulic-pressure-supply equipment which supplies oil pressure to this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which does not use the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, The nut decollator which supplies a separation command signal to the above-mentioned separation nut, The automobile collision G simulator characterized by providing the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned nut decollator at the time of the force application termination to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] 0007
[Method of Amendment] Modification
[Proposed Amendment]
[0007]
[Means for Solving the Problem] The hydraulic-pressure-supply equipment with which the automobile collision G simulator concerning this invention supplies oil pressure to an actuator and this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which used the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, It is characterized by providing the ignition which supplies the power source for ignition to the above-mentioned separation nut, and the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned ignition at the time of the force application termination to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.
[Procedure amendment 3]

[Document to be Amended] Specification
[Item(s) to be Amended] 0008
[Method of Amendment] Modification
[Proposed Amendment]
[0008] Moreover, the automobile collision G simulator concerning this invention An actuator and the hydraulic-pressure-supply equipment which supplies oil pressure to this actuator, A servo control means to control the oil pressure supplied to the above-mentioned actuator from this hydraulic-pressure-supply equipment, The ultra high-speed separation joint which comes to incorporate the separation nut which does not use the powder which connects between the output shaft of the above-mentioned actuator, and simulation cars, It is characterized by providing the nut decollator which supplies a separation command signal to the above-mentioned separation nut, and the control unit into which operate the above-mentioned actuator with the above-mentioned servo control means, operate the above-mentioned nut decollator at the time of the force application termination to the above-mentioned simulation car, and the above-mentioned ultra high-speed separation joint is made to divide.
[Procedure amendment 4]
[Document to be Amended] Specification
[Item(s) to be Amended] 0019
[Method of Amendment] Modification
[Proposed Amendment]
[0019] Next, actuation of the above-mentioned example is explained. In case a trial is started, a trial start signal is inputted into the control unit 5 in drawing 1 by actuation of turning on a start switch. Thereby, as the processor 5-1 shown in drawing 2 operates and it is shown in drawing 4 , a control unit 5 is a certain specified timing, from the servo-system command signal dispatch section 5-2, outputs a collision G command signal to servo system 1, and starts a trial. It is t0 at this output initiation time. It is referred to as "0" of time base. A servo valve 12 is opened based on the servo-system command signal by which the servo control 13 of servo system 1 was sent from the above-mentioned servo-system command signal dispatch section 5-2, and it came, the oil pressure supplied to an actuator 11 through a hydraulic line 3 from hydraulic-pressure-supply equipment 2 is controlled, and the target G wave shown in drawing 4 is realized.
[Procedure amendment 5]
[Document to be Amended] Specification
[Item(s) to be Amended] 0020
[Method of Amendment] Modification
[Proposed Amendment]
[0020] Moreover, the processor 5-1 in the control unit 5 shown in drawing 2 is the operating time of delta 1 and the separation nut 4-5 about the operating time of an ignition 9 delta 2 When it carries out, it is from time base "0",
deltatF =deltat1 - (delta1+delta2)
When it passes, the ignition command signal of the separation nut 4-5 is sent, and it outputs to an ignition 9. Based on the above-mentioned ignition command signal, through electric-wire 9a for ignition, an ignition 9 supplies a current to the separation nut 4-5 from the power source for ignition, and lights a powder. The separation nut 4-5 dissociates by this, it separates from a bolt 4-4, and, as for the ultra high-speed separation joint 4, 1 set of bodies 4-1 of a joint are divided into right and left. On the other hand, since output-shaft 11a of an actuator 11 stops by the stroke edge, the simulation car 6 is separated from output-shaft 11a of an actuator 11 by inertial force, and it moves that rate when dissociating, and is deltat2. It slows down and stops, after ending a trial.
[Procedure amendment 6]
[Document to be Amended] Specification

[Item(s) to be Amended] 0021
[Method of Amendment] Modification
[Proposed Amendment]
[0021] t0 to which measurement of data started the trial A point in time to deltat2 up to -- it carries out. That is, as shown in drawing 4 , Target G is given to the simulation car 6, and the amount of many then generated in a human phantom 10 is measured. Target G -- G fundamental-wave top -- oscillating G of a RF -- deltat1 up to -- it is added and the condition of "0" G maintains after it -- having -- the test initiation back deltat2 A trial is ended.
[Procedure amendment 7]
[Document to be Amended] Specification
[Item(s) to be Amended] 0022
[Method of Amendment] Modification
[Proposed Amendment]
[0022] deltat1 separated so that above-mentioned drawing 4 might show although there is no need for force application henceforth -- if -- deltat2 of test termination up to -- supposing output-shaft 11a of an actuator 11 and the simulation car 6 were combined -- which -- about -- it is as follows, when an unnecessary stroke is needed or an order check is carried out.
[Procedure amendment 8]
[Document to be Amended] Specification
[Item(s) to be Amended] 0026
[Method of Amendment] Modification
[Proposed Amendment]
[0026] For this reason, a decollator is deltat1. It is necessary to dissociate by ultra high-speed correctly. Since the mass of a separation joint influences the force application engine performance directly, it needs to collect lightweight.
[Procedure amendment 9]
[Document to be Amended] DRAWINGS
[Item(s) to be Amended] drawing 4
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 4]


試験開始
継手分離
試験終了
G進行方向加速度
+
−
目標G
Δt1
Δt2(≒4
G基本波
データ計測時間
Δ1 Δ2
ΔtF
点火指令
信号発信

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Ｇ０１Ｍ　17/007				
Ｇ０１Ｐ　15/00	Ｄ			
			Ｇ０１Ｍ　17/ 00	Ｚ

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(33)優先権主張国　日本（ＪＰ）

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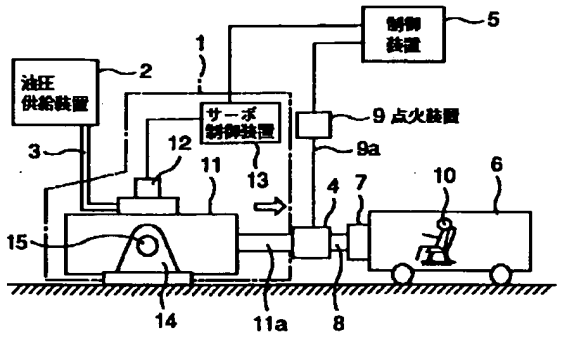
(54)【発明の名称】　自動車衝突Ｇシミュレータ

(57)【要約】

【目的】　より現実的な衝突シミュレーションが可能で、衝突時の保護装置の評価等を高精度で行なうことができる自動車衝突Ｇシミュレータを提供する。

【構成】　制御装置５は、サーボ制御装置１３に衝突Ｇ指令信号を出力して試験を開始する。サーボ制御装置１３は、指令信号に基づいて油圧供給装置２からアクチュエータ１１に供給される油圧を制御し、目標Ｇを実現させる。また、制御装置５は、アクチュエータ１１による加力終了後、分離ナットの点火指令信号を点火装置９に出力する。点火装置９は、点火指令信号に基づき分離ナットに電流を供給して火薬を点火し、超高速分離継手４を分離する。アクチュエータ１１の出力軸１１ａは、そのストローク端で停止するので、模擬車両６は慣性力によりアクチュエータ１１の出力軸１１ａから切り離され、その後、減速して停止する。この結果、高周波を含む衝突Ｇの加力が可能になる。



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【特許請求の範囲】

【請求項1】　アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置から上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用した分離ナットを組込んでなる超高速分離継手と、上記分離ナットに点火用電源を供給する点火装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了後に上記点火装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする自動車衝突Gシミュレータ。

【請求項2】　アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置から上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用しない分離ナットを組込んでなる超高速分離継手と、上記分離ナットに分離指令信号を供給するナット分離装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了後に上記ナット分離装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする自動車衝突Gシミュレータ。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、超高速分離装置を用いた自動車衝突Gシミュレータに関する。

【0002】

【従来の技術】従来の自動車衝突Gシミュレータは、図8に示すように構成されている。即ち、床面上に固定設置された反力壁20に対してアクチュエータ21を設け、そのアクチュエータ出力軸21aに対向するように模擬車両22の加圧部23を位置させている。上記模擬車両22内の座席には、人体模型24が設置される。そして、上記アクチュエータ21には、空気源25が開閉バルブ26及び空圧配管27を介して連結される。

【0003】上記の構成において、シミュレーションを行なう場合には、開閉バルブ26を急激に開くことにより、空気源25からの空気圧を空圧配管27を通してアクチュエータ21に供給し、アクチュエータ出力軸21aが模擬車両22の加圧部23に衝突させ、その時の反力は反力壁20で吸収する。

【0004】

【発明が解決しようとする課題】上記従来の自動車衝突Gシミュレータは、アクチュエータ出力軸21aと模擬車両22が分離しており、アクチュエータ出力軸21aを模擬車両22の加圧部23に衝突させる方式を用いているため、G基本波の模擬程度が限界である。

【0005】また、アクチュエータ出力軸21aと模擬車両22を結合した結合型として油圧サーボバルブを目

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標Gが得られるように作動させることは可能であるが、アクチュエータのストロークが長くなるために応答性が悪くなり、結果として目標Gを得ることができない。

【0006】本発明は上記実情に鑑みてなされたもので、アクチュエータのストロークを加力に必要な最小ストロークにすると共に、加力終了後アクチュエータと模擬車両を切り離すことで目標Gを実現させ、より現実的な衝突シミュレーションが可能で、衝突時の保護装置の評価等を高精度で行なうことができる自動車衝突Gシミュレータを提供することを目的とする。

【0007】

【課題を解決するための手段】本発明に係る自動車衝突Gシミュレータは、アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置から上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用した分離ナットを組込んでなる超高速分離継手と、上記分離ナットに点火用電源を供給する点火装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了後に上記点火装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする。

【0008】また、本発明に係る自動車衝突Gシミュレータは、アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置から上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用しない分離ナットを組込んでなる超高速分離継手と、上記分離ナットに分離指令信号を供給するナット分離装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了後に上記ナット分離装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする。

【0009】

【作用】試験開始信号を制御装置に入力すると、制御装置は、所定のタイミングで、サーボ制御手段に衝突G指令信号を出力して試験を開始する。サーボ制御手段は、サーボ系指令信号に基づいて油圧供給装置からアクチュエータに供給される油圧を制御し、目標Gを実現させる。

【0010】一方、制御装置は、アクチュエータによる加力終了後、分離ナットの点火指令信号を点火装置に出力する。点火装置は、点火指令信号に基づき分離ナットに電流を供給して火薬を点火し、超高速分離継手を分離する。アクチュエータの出力軸は、そのストローク端で停止するので、模擬車両は慣性力によりアクチュエータの出力軸から切り離され、その分離した時の速度で移動し、その後、減速して停止する。

【0011】また、火薬を使用しない超高速分離継手を

使用した場合においては、ナット分離装置が制御装置からの指令に従って超高速分離継手を制御することで、上記火薬を使用した超高速分離継手の場合と同様の動作が行なわれる。

【００１２】上記のようにして目標Ｇを模擬車両内の人体模型に与え、そのとき人体模型に発生する諸量等を計測する。この結果、アクチュエータのストロークを加力に必要な最小ストロークにできると共に、加力終了後アクチュエータと模擬車両を切り離すことにより、高周波を含む衝突Ｇの加力が可能になり、より現実的な衝突シミュレーションが可能となる。

【００１３】

【実施例】以下、図面を参照して本発明の実施例を説明する。

（第１実施例）図１は、本発明の第１実施例に係る自動車衝突Ｇシミュレータの全体的な構成図である。図１において、１はサーボ系で、アクチュエータ１１、サーボバルブ１２、サーボ制御装置１３、及び自動調心型の軸受けを装備したトラニオン軸受１４から構成されている。上記トラニオン軸受１４は、床面上に設置され、トラニオン軸１５を介してアクチュエータ１１を保持する。上記サーボバルブ１２は、油圧供給装置２から油圧配管３を介してアクチュエータ１１に供給される油圧を制御するもので、サーボ制御装置１３からの指令に従って開閉動作する。また、このサーボ制御装置１３には、全体の制御を司る制御装置５から制御指令が与えられる。

【００１４】そして、上記アクチュエータ１１の出力軸１１ａは、超高速分離継手４を介して模擬車両６に連結される。この模擬車両６の座席には、人体模型１０が設置されており、目標Ｇが与えられたときに人体模型１０に発生する諸量等を計測するようになっている。また、上記模擬車両６には、自動調心型の軸受を装備した左右回転軸７が設けてあり、この左右回転軸７が連結軸８を介して上記超高速分離継手４に連結される。この超高速分離継手４は、詳細を後述するように火薬を使用した分離ナット等により構成したもので、スイッチ点火装置９より点火用電線９ａを介して点火電流が供給される。上記点火装置９は、分離ナット点火用の電源及びスイッチ等よりなり、上記制御装置５からの制御指令に従って動作する。

【００１５】上記制御装置５は、図２に示すようにプロセッサ５－１及びサーボ系指令信号発信部５－２により構成されており、試験開始入力信号によりプロセッサ５－１が動作を開始する。これによりサーボ系指令信号発信部５－２から上記サーボ制御装置１３にサーボ系指令信号が送られると共に、プロセッサ５－１から上記点火装置９に点火指令信号が送られる。

【００１６】次に図３により上記超高速分離継手４の詳細について説明する。この超高速分離継手４は、フォーク型の継手本体４－１に、結合板４－２を固定ピン４－３で結合した１組の継手を相対向させ、１組のボルト４－４及び分離ナット４－５でワッシャ４－６を入れて結合する。上記結合板４－２の中心部には、ボルト４－４の直径より大きい透孔４－７が設けられており、左右の継手本体４－１の芯が多少ずれても、ボルト４－４が取り付けられるようになっている。上記分離ナット４－５は、火薬を使用して分離動作を行なわせるもので、例えば米国のHi-Shear　Corporationより「ＳＮ１１００　and　ＳＮ２１００ seriees Non-Captive Separation Nuts」が発売されている。また、分離ナットの他、分離ボルトも発売されており、上記分離ナット４－５の代わりに分離ボルトを使用して同様の動作を行なわせることができる。

【００１７】そして、分離ナット４－５が分離後、飛散したり、抜けたボルト４－４等が飛散しないようにカバー４－８が継手本体４－１に固定ネジ４－９で固定されている。上記カバー４－８は、取付け、取外しが可能な構造になっている。また、上記分離ナット４－５には、上記点火装置９からの点火用電線９ａが接続される。この点火用電線９ａは、電線クランプ４－１０により、継手本体４－１に固定され、試験中の衝撃、振動により、点火用電線９ａがカバー４－８に接触して切断等が発生しないようにしている。

【００１８】上記超高速分離継手４を使用する場合、この実施例では分離ナット４－５を装着したボルト４－４に無理な曲げ応力等が加わらないように、アクチュエータ１１側に自動調心型の軸受けを装備したトラニオン軸受１４を設けてトラニオン軸１５を受けると共に、模擬車両６側でも自動調心型の軸受けを装備した左右回転軸７を設けている。なお、分離ナット４－５の作動に影響を与える力が働かないような機構であれば、その他の機構を用いても良いことは勿論である。

【００１９】次に上記実施例の動作を説明する。試験を開始する際、スタートスイッチをＯＮするなどの操作により、試験開始信号を図１における制御装置５に入力する。これにより制御装置５は、図２に示すプロセッサ５－１が作動し、図４に示すように、ある規定されたタイミングで、サーボ系指令信号発信部５－２よりサーボ系１に対し衝突Ｇ指令信号を出力して試験を開始する。この出力開始時点ｔ０を時間基準の“０”とする。サーボ系１のサーボ制御装置１３は、上記サーボ系指令信号発信部５－２から送られきたサーボ系指令信号に基づいてサーボバルブ１２を開き、油圧供給装置２から油圧配管３を介してアクチュエータ１１に供給される油圧を制御し、図４に示すＧ波形を実現させる。

【００２０】また、図２に示す制御装置５内のプロセッサ５－１は、点火装置９の作動時間をΔ１、分離ナット４－５の作動時間をΔ２とすると、時間基準“０”より、

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$\Delta tF = \Delta t1 - (\Delta 1 + \Delta 2)$

を経過した時点で、分離ナット４－５の点火指令信号を発信し、点火装置９に出力する。点火装置９は、上記点火指令信号に基づき点火用電線９ａを介して分離ナット４－５に点火用電源より電流を供給して火薬を点火する。これにより分離ナット４－５が分離してボルト４－４から外れ、超高速分離継手４は１組の継手本体４－１が左右に分かれる。一方、アクチュエータ１１の出力軸１１ａは、そのストローク端で停止するので、模擬車両６は慣性力によりアクチュエータ１１の出力軸１１ａから切り離され、その分離した時の速度で移動し、Δｔ２で分離を終了した後、減速して停止する。

【００２１】データの計測は、試験を開始したｔ０ 時点から模擬車両６が分離を終了したΔｔ２ まで行なう。即ち、図４に示すように目標Ｇを人体模型１０に与え、そのとき人体模型１０に発生する諸量等を計測する。目標Ｇは、Ｇ基本波の上に高周波の振動的ＧがΔｔ１ まで加わり、それ以後は“０”Ｇの状態が保たれ、試験開始後Δｔ２ で試験を終了する。

【００２２】上記図４から分かるように分離を開始したΔｔ１ 以後は、加力の必要はないが、もし、分離終了のΔｔ２ までアクチュエータ１１の出力軸１１ａと模擬車両６が結合されていたとすると、どの位不要のストロークを必要とするか、オーダチェックすると次のようになる。

【００２３】一般にΔｔ１ は、略０．１ｓｅｃ（秒）である。このとき模擬車両６は、最大速度Ｖmax が略１５ｍ／ｓｅｃとなっている。従って、この場合の不要なストロークは、

【００２４】

【数１】

$$\ell \fallingdotseq (\Delta t2 - \Delta t1)\, Vmax$$
$$\fallingdotseq 3\Delta t1\, Vmax$$
$$= 3 \times 0.1(sec) \times 15(m/sec)$$
$$= 4.5\ (m)$$

となる。なお、加力に必要なストロークは１ｍ以下であるので、不要なストロークの値が非常に大きいことが分かる。また、分離時間が１／１０００ｓｅｃずれるとすると、

【００２５】

【数２】

$$\Delta\ell \fallingdotseq 1500(cm/sec) \times 1/1000(sec)$$
$$= 1.5(cm)$$

ストロークが変化することになる。

【００２６】このため分離装置は、Δｔ２ で正確に、かつ、超高速で分離する必要がある。分離継手の質量は、加力性能に直接影響するので、軽量にまとめることが必

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要である。

【００２７】上記したよう試験開始から図４に示すΔｔ１までは、アクチュエータ１１の出力軸１１ａを超高速分離継手４を介して模擬車両６と結合して加力し、それ以後は、超高速分離継手４を作動させて模擬車両６を分離することにより、アクチュエータ１１のストロークを短くして油の圧縮性等による性能低下を抑えることができ、高周波を含む衝突Ｇの加力が可能になる。

【００２８】なお、上記実施例では、１本の分離ナット４－５を用いた場合について説明したが、１本の分離ナットでは荷重を受け切れないような時には、図５に示すように２本の分離ナット４－５を組合わせて使用するようにしてもよい。図５（ａ）は超高速分離継手４の断面図、同図（ｂ）はその側面図である。この図５に示す実施例では、１組の継手本体４－１の頭部をフランジ状に形成して対向配置し、その周縁部を２組のボルト４－４及び分離ナット４－５により、ワッシャ４－６を入れて結合している。上記２本の分離ナット４－５には、点火装置９から点火用電線９ａを介して電流を供給する。そして、継手本体４－１の外側にカバー４－８を配置し、固定ネジ４－９で固定している。また、継手本体４－１の中心部には、アクチュエータ１１の出力軸１１ａ、模擬車両６の連結軸８を連結するためのネジ孔４－１１を設けている。

【００２９】上記のように２本の分離ナット４－５を用いることにより、充分大きな荷重に耐えることができる。また、その他、特に分離ナット４－５について高い信頼性が要求される場合には、図３に示した超高速分離継手４において、ボルト４－４に代えてスタッドを使用し、その両端に分離ナット４－５を装着するようにしてもよい。このように２つの分離ナット４－５を組合わせて使用することにより、模擬車両６の分離をより確実に行なうことができる。

【００３０】（第２実施例）図６は、本発明の第２実施例に係る自動車衝突Ｇシミュレータの全体的な構成図である。この第２実施例は、火薬を使用した超高速分離継手４に代えて火薬を用いない超高速分離継手４Ａを使用したもので、ナット分離装置９Ａより分離信号線９ｂを介してナット分離信号が供給される。上記ナット分離装置９Ａは、高速分離ナット作動用の電源、リレー等よりなり、上記制御装置５からの制御指令に従って動作する。その他の構成は、図１と同様の構成であるので、図１と同一符号を付して詳細な説明は省略する。

【００３１】次に上記超高速分離継手４Ａの詳細について図７により説明する。この超高速分離継手４Ａは、１組の継手本体４ａを相対向させ、１組のボルト４ｂ及び分離ナット４ｃでワッシャ４ｄを入れて結合する。この場合、上記継手本体４ａの対向面の中心部には、ボルト４ｂの直径より大きい透孔４ｅが設けられており、左右の継手本体４ａの芯が多少ずれても、ボルト４ｂが取り

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付けられるようになっている。また、分離ナット４ｃは、一方の継手本体４ａに取付ボルト４ｆにより予め固定されている。

【００３２】上記分離ナット４ｃは、火薬を使用せずに電気的及び機械的な作用により分離動作を行なわせるもので、例えば米国のG&H Technology .Inc. より「Model９４２１－２、Model ８５００のSeparation Nut」が発売されている。

【００３３】そして、上記分離ナット４ｃには、上記ナット分離装置９Ａからの分離信号線９ｂが接続される。この分離信号線９ｂは、電線クランプ４ｇにより、継手本体４ａに固定され、試験中の衝撃、振動により、断線等の不具合が生じないようにしている。

【００３４】上記火薬を用いない超高速分離継手４Ａを使用した図６の自動車衝突Gシミュレータにおいても、制御装置５からの指示に基づいて前記第１実施例と全く同様の動作が行なわれ、同様の効果を得ることができる。

【００３５】

【発明の効果】以上詳記したように本発明によれば、アクチュエータのストロークを加力に必要な最小ストロークにすると共に、加力終了後アクチュエータと模擬車両を切り離すことにより目標Gを実現するようにしたので、高周波を含む衝突Gの加力が可能になり、より現実的な衝突シミュレーションが可能で、衝突時の保護装置の評価等を高精度で行なうことができる。

【図面の簡単な説明】

【図１】本発明の第１実施例に係る自動車衝突Gシミュレータの構成図。

【図２】同実施例における制御装置の主要構成を示すブロック図。

【図３】同実施例における超高速分離継手の構成を一部断面して示す図。

【図４】同実施例における計測動作を説明するための図。

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【図５】本発明における超高速分離継手の他の構成例を示す図。

【図６】本発明の第２実施例に係る自動車衝突Gシミュレータの構成図。

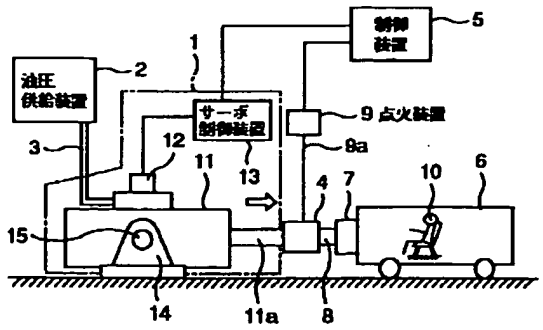
【図７】同実施例における超高速分離継手の構成を一部断面して示す図。

【図８】従来の自動車衝突Gシミュレータの構成図。

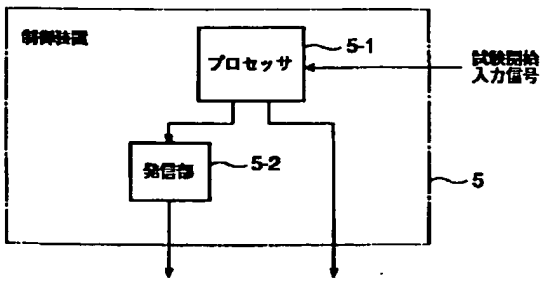
【符号の説明】

１　サーボ系
２　油圧供給装置
３　油圧配管
４，４Ａ　超高速分離継手
４－１，４ａ　継手本体
４－２　結合板
４－３　固定ピン
４－４，４ｂ　ボルト
４－５，４ｃ　分離ナット
４－６，４ｄ　ワッシャ
４－７，４ｅ　透孔
４－８　カバー
４－９　固定ネジ
４－１０，４ｇ　電線クランプ
５　制御装置
６　模擬車両
７　左右回転軸
８　連結軸
９　点火装置
１０　人体模型
１１　アクチュエータ
１１ａ　アクチュエータ出力軸
１２　サーボバルブ
１３　サーボ制御装置
１４　トラニオン軸受
１５　トラニオン軸

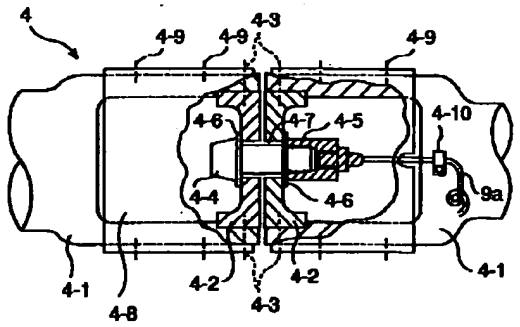
【図１】



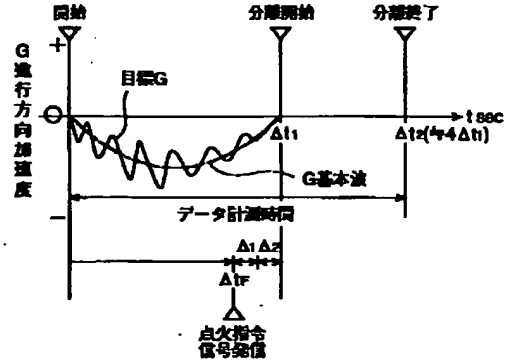
【図２】



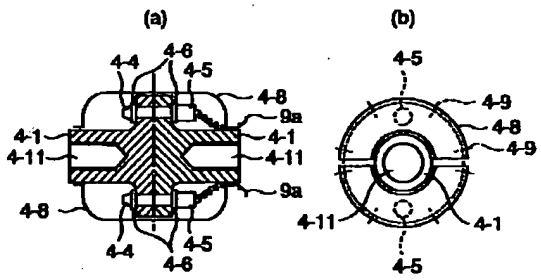
【図3】



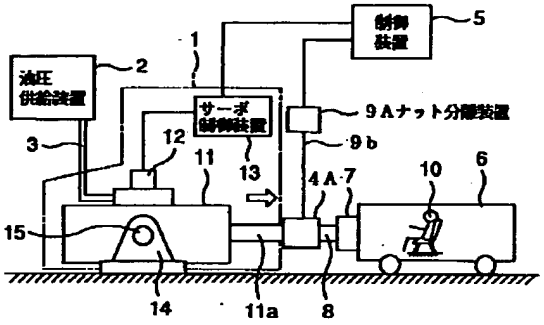
【図4】



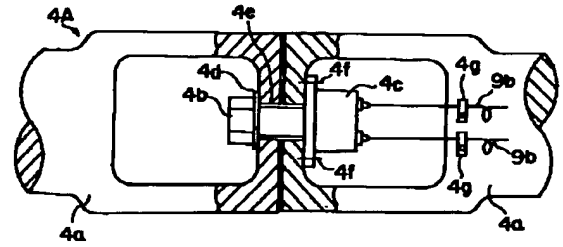
【図5】



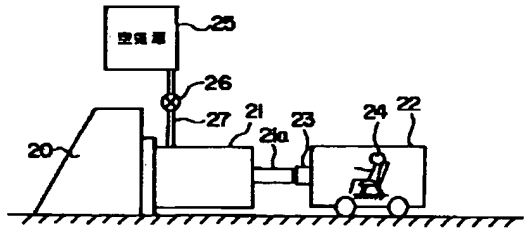
【図6】



【図7】



【図8】



【手続補正書】
【提出日】平成７年１月１１日
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】特許請求の範囲
【補正方法】変更
【補正内容】
【特許請求の範囲】
【請求項１】　アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置から上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用した分離ナットを組込んでなる超高速分離継手と、上記分離ナットに点火用電源を供給する点火装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了時に上記点火装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする自動車衝突Gシミュレータ。

【請求項2】　アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置から上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用しない分離ナットを組込んでなる超高速分離継手と、上記分離ナットに分離指令信号を供給するナット分離装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了時に上記ナット分離装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする自動車衝突Gシミュレータ。

【手続補正2】
【補正対象書類名】明細書
【補正対象項目名】0007
【補正方法】変更
【補正内容】
【0007】
【課題を解決するための手段】本発明に係る自動車衝突Gシミュレータは、アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置から上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用した分離ナットを組込んでなる超高速分離継手と、上記分離ナットに点火用電源を供給する点火装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了時に上記点火装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする。

【手続補正3】
【補正対象書類名】明細書
【補正対象項目名】0008
【補正方法】変更
【補正内容】
【0008】また、本発明に係る自動車衝突Gシミュレータは、アクチュエータと、このアクチュエータに油圧を供給する油圧供給装置と、この油圧供給装置から上記アクチュエータへ供給される油圧を制御するサーボ制御手段と、上記アクチュエータの出力軸と模擬車両との間を連結する火薬を使用しない分離ナットを組込んでなる超高速分離継手と、上記分離ナットに分離指令信号を供給するナット分離装置と、上記サーボ制御手段により上記アクチュエータを作動させ上記模擬車両への加力終了時に上記ナット分離装置を作動させて上記超高速分離継手を分離させる制御装置とを具備したことを特徴とする。

【手続補正4】
【補正対象書類名】明細書
【補正対象項目名】0019
【補正方法】変更
【補正内容】
【0019】次に上記実施例の動作を説明する。試験を開始する際、スタートスイッチをONするなどの操作により、試験開始信号を図1における制御装置5に入力する。これにより制御装置5は、図2に示すプロセッサ5－1が作動し、図4に示すように、ある規定されたタイミングで、サーボ系指令信号発信部5－2よりサーボ系1に対し衝突G指令信号を出力して試験を開始する。この出力開始時点t0 を時間基準の“0”とする。サーボ系1のサーボ制御装置13は、上記サーボ系指令信号発信部5－2から送られきたサーボ系指令信号に基づいてサーボバルブ12を開き、油圧供給装置2から油圧配管3を介してアクチュエータ11に供給される油圧を制御し、図4に示す目標G波形を実現させる。

【手続補正5】
【補正対象書類名】明細書
【補正対象項目名】0020
【補正方法】変更
【補正内容】
【0020】また、図2に示す制御装置5内のプロセッサ5－1は、点火装置9の作動時間をΔ1 、分離ナット4－5の作動時間をΔ2 とすると、時間基準“0”より、

$$\Delta tF = \Delta t1 - (\Delta 1 + \Delta 2)$$

を経過した時点で、分離ナット4－5の点火指令信号を発信し、点火装置9に出力する。点火装置9は、上記点火指令信号に基づき点火用電線9aを介して分離ナット4－5に点火用電源より電流を供給して火薬を点火する。これにより分離ナット4－5が分離してボルト4－4から外れ、超高速分離継手4は1組の継手本体4－1が左右に分かれる。一方、アクチュエータ11の出力軸11aは、そのストローク端で停止するので、模擬車両6は慣性力によりアクチュエータ11の出力軸11aから切り離され、その分離した時の速度で移動し、Δt2 で試験を終了した後、減速して停止する。

【手続補正6】
【補正対象書類名】明細書
【補正対象項目名】0021
【補正方法】変更
【補正内容】
【0021】データの計測は、試験を開始したt0 時点からΔt2 まで行なう。即ち、図4に示すように目標Gを模擬車両6に与え、そのとき人体模型10に発生する諸量等を計測する。目標Gは、G基本波の上に高周波の振動的GがΔt1 まで加わり、それ以後は“0”Gの状態が保たれ、試験開始後Δt2 で試験を終了する。

【手続補正7】
【補正対象書類名】明細書
【補正対象項目名】0022
【補正方法】変更
【補正内容】

【0022】上記図4から分かるように分離したΔt1以後は、加力の必要はないが、もし、試験終了のΔt2までアクチュエータ11の出力軸11aと模擬車両6が結合されていたとすると、どの位不要のストロークを必要とするか、オーダチェックすると次のようになる。

【手続補正8】
【補正対象書類名】明細書
【補正対象項目名】0026
【補正方法】変更
【補正内容】

【0026】このため分離装置は、Δt1で正確に、かつ、超高速で分離する必要がある。分離継手の質量は、加力性能に直接影響するので、軽量にまとめることが必要である。

【手続補正9】
【補正対象書類名】図面
【補正対象項目名】図4
【補正方法】変更
【補正内容】
【図4】